Volume I:

REMEDIAL INVESTIGATION/FEASABILITY STUDY WORK PLAN OF THE UPLANDS ENVIRONMENT AT THE FORMER RAYONIER PULP MILL SITE

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ACRONYMS AND ABBREVIATIONS

AOX	adsorbable organic halides
ARAR	applicable, relevant, and appropriate requirement
ATSDR	Agency for Toxic Substances and Disease Registry
BAF	bioaccumulation factor
bgs	below ground surface
BHC	hexachlorocyclohexane
BOD	biochemical oxygen demand
BW	body weight
CAO	Cleanup Action Objective
CDD	chlorinated dibenzo-p-dioxin
CDF	chlorinated dibenzofuran
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CLARC	cleanup levels and risk calculations
CLP	contract laboratory program
COC	chemical of concern
COPC	contaminant of potential concern
CRDL	contract required detection limit
CRQL	contract required quantitation limit
CS/SCM	current situation/site conceptual model
CSF	cancer slope factor
CSM	conceptual site model
cy	cubic yard
DL	detection limit
DQO	data quality objective
E&E	Ecology and Environment, Inc.
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESI	expanded site inspection
ESU	evolutionarily significant unit

FOL	field operations lead
FS	feasibility study
FSP	field sampling plan
FSQV	freshwater sediment quality values
GMW	groundwater monitoring well
HASP	Health and Safety Plan
HDPE	high-density polypropylene
HEAST	Health Effects Summary Tables
HI	hazard index
HLA	Harding Lawson Associates
HpCDD	heptachlorodibenzo-p-dioxin
HQ	hazard quotient
HSM	health and safety manager
ICP	inductively coupled argon plasma
IRIS	Integrated Risk Information System
ISC3	Industrial Source Complex Model
ISCLT3	Industrial Source Long-Term Model
ISCST3	Industrial Source Short-Term Model
LAAS	Larson Anthropological/Archaeological Services
LOAEL	lowest observed adverse effect level
MDL	method detection limit
MF	modifying factor
mg	milligram
mg/L	milligrams per liter
mg/kg	milligrams per kilogram
MLLW	mean lower low water
MTCA	Model Toxics Control Act
MW	monitoring well
NCDC	National Climatic Data Center
ng/kg	nanograms per kilogram
NGVD	National Geodetic Vertical Datum
NIST	National Institute of Standards and Testing
NMFS	National Marine Fisheries Service
NOAEL	no observed adverse effect level

NPDES	National Pollution Discharge Elimination System
NPL	National Priorities List
OCDD	octa-chlorinated dibenzodioxins
PAET	probable apparent effects threshold
PAH	polyaromatic hydrocarbon
PCBs	polychlorinated biphenyls
PCDD	polychlorinated dibenzo-p-dioxin
PCDF	polychlorinated dibenzofuran
PeCDF	tetrachlorinated dibenzofuran
pg	picogram
PHS	Priority Habitat Species
PM	project manager
PSAMP	Puget Sound Avian Monitoring Project
PSDS	Puget Sound Distinctive Segment
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RA	risk assessment
Rayonier	Rayonier, Inc.
RfC	reference concentration
RfD	reference dose
RGAF	gut absorption factor
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
RME	reasonable maximum exposure
RTAG	Rayonier Technical Advisory Group
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SCS	Soil Conservation Service
SECOR	SECOR International Incorporated
SEPA	State Environmental Protection Act
SMT	site management team
SQS	sediment quality standards
SSL	spent sulfite liquor

SVOCs	semivolatile organic compounds
TBD	to be determined
TCDD	tetrachlorodibenzo-p-dioxin
TCDF	tetrachlorodibenzo-p-furan
TCLP	toxicity characteristic leaching procedure
TEQ	toxic equivalent concentration
TEF	toxicity equivalency factor
TOC	total organic carbon
TPH	total petroleum hydrocarbon
TPH-D	total petroleum hydrocarbon-diesel
TPH-G	total petroleum hydrocarbon-gasoline
Tribe	The Lower Elwha Klallam Tribe
TSCA	Toxic Substance Control Act
TSS	total suspended solids
UCL	upper confidence level
UF	uncertainty factor
μg/L	micrograms per liter
μL	microliter
USFWS	U.S. Fish and Wildlife Service
VOC	volatile organic compound
WAC	Washington Administrative Code
WDF	Washington Department of Fisheries
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington Department of Natural Resources
WTPH-D extended	total petroleum hydrocarbons, extended

GLOSSARY

Accuracy— The agreement between a reported result and the true value.

Action Limit—A value for results of a quality control (QC) analysis that requires appropriate action to be taken to correct the performance of a system or a method that is not in control. Action limits and appropriate corrective actions are specified contractually. Data obtained when a system or method is not in control may be omitted from a regional database. [Note: in a multianalyte method, failure to meet the calibration requirement for a small percentage of analytes should not be cause to omit the entire analysis for a sample from the database. Omission should be determined on an analyte-by-analyte basis. Action limits and appropriate corrective actions are specified contractually.]

Analyte—That which is identified and quantified in the process of analyzing the sample.

Assessment—The evaluation process used to measure the performance or compliance of sampling and analysis activities.

Audit—A systematic and independent examination to determine whether sampling and analysis activities and related results comply with planned practices, whether these practices are implemented effectively, and whether the nature and extent of these practices are suitable for the sampling and analysis activities they support.

Batch—The number of samples that are prepared or analyzed with associated laboratory QC samples at one time. A typical batch size is 20 samples.

Bias—The systematic or persistent distortion of a measurement process which causes errors in one detection.

Blank-corrected Result—Refers to an analytical result that has been corrected (mathematically or through analytical procedures) for the contribution of the method blank. The method blank should be processed concurrently. Any correction should account mathematically for all relevant weights, volumes, dilutions, and other similar sample processing elements.

Calibration—The determination of the relationship between instrument response and measurement (e.g., concentration or mass of the analyte).

Certified Reference Material—A reference material accompanied by, or traceable to, a certificate stating the concentration of chemicals contained in the material. The certificate is issued by an organization, public or private, that routinely certifies such

material (e.g., National Institute of Standards and Testing, or the National Research Council of Canada).

Chain of Custody—An unbroken trail of accountability that ensures the physical security of samples, data, and records.

Check Standard—A QC sample prepared independent of calibration standards, analyzed exactly like the samples, and used to estimate analytical precision and to indicate bias due to calibration.

Coefficient of Variation—The standard deviation expressed as a percentage of the mean. Also termed "relative standard deviation".

Comparability—An indication of the confidence with which one data set can be compared to another.

Completeness—A measure of the amount of valid data obtained from sampling and analysis activities compared to the amount that was expected to be obtained.

Conceptual Site Model (CSM)—Information on the contamination, fate and transport, and receptors potentially present at a site. The model is used as a tool in risk assessment to describe relationships between chemical contaminants and potentially exposed receptor organisms. The conceptual site model includes known and suspected sources of contamination, types of contaminants, affected media, known and potential routes of migration, and known or potential human and ecological receptors.

Congener—In the context of dioxins or furans, structures with the same degree (number) of chlorine atoms. For example 1,2,3,4,7,8-hexachloro dibenzo dioxin and 1,2,3,6,7,8-hexachloro dibenzo dioxin, are congeners.

Consent Decree—A written agreement developed by regulatory agencies such as the U.S. Environmental Protection Agency (EPA) to document agreed-upon assessment and cleanup measures to be applied to a site that has environmental impacts justifying state jurisdiction.

Control Limit(s)—A value or range of values against which results of QC sample analyses are compared in order to determine whether the performance of a system or method is acceptable. Control limits are typically statistically derived. When QC results exceed established control limits, appropriate corrective action should be taken to adjust the performance of the system or method.

Corrective Action—Measures taken to remove, adjust, remedy, or counteract a malfunction or error so that a standard or required condition is subsequently met.

Data Quality Objectives (DQOs)—DQOs are qualitative and quantitative statements that define the appropriate type and quality of data needed to support the objective of a given project.

Detection Limit—In analytical chemistry, a threshold concentration for a compound below which its presence cannot be measured. The threshold concentration results from a number of different influences, including interference from other compounds in the sample or the inherent limits of the measuring instrument in resolving the measurement signal.

Dioxin—A generic term, often used to describe a group of 210 structurally related halogenated aromatic hydrocarbons. These compounds are distributed between two classes, the polychlorinated dibenzodioxins and the polychlorinated dibenzofurans.

Duplicate Analysis—Analysis performed on a second subsample in the same manner as the initial analysis, it is used to provide an indication of measurement precision.

Exposure Pathway—The route a chemical would take through the environment from the time of its release until it reaches that point where a receptor is exposed. For example, the release of a chemical during the burning of some material could end up collecting on nearby vegetation. Rain would wash some of it off onto the ground where it might run off into a nearby pond. Fish in the pond would adsorb some through their gills and it might collect in the fish's fatty tissues. A fisherman could catch and eat the fish. The exposure to a chemical might be measured at several different places along this pathway.

Feasibility Study (FS)—An investigation or study that provides identification and evaluation of site cleanup alternatives. It stems from the RI process and is followed by the cleanup action plan. The FS evaluates site information and associated technology data to enable the selection of a cleanup action plan.

Field Blank—A simulated sample (usually consisting of laboratory pure water) that is taken through all phases of sample collection and analysis. Results of field blank analyses are used to assess the positive contribution from sample collection and analysis procedures to the final result.

Guideline—A recommended practice that is nonmandatory.

Health and Safety Plan (HASP)—A plan to help ensure worker health and safety while conducting investigations at the former Rayonier Mill Site. It includes sections on protective clothing, decontamination, emergency medical information, and information on potential contaminants.

Inductively Coupled Argon Plasma Optical Emission Spectroscopy (ICP)—A technique for simultaneous or rapid sequential analysis for many elements in a short

time. Element-specific, atomic-emission line spectra of nebulized samples are produced by a radio frequency inductively coupled plasma.

Interference Check Sample—A sample run by inductively coupled argon plasma methodology to verify interelement and background correction factors.

Management Plan—This is a cumulative document of various plans, including the conceptual site model (CSM), sampling and analysis plan (SAP), Health and Safety Plan (HASP), and quality assurance project plan (QAPP).

Matrix—The sample material in which the analytes of interest are found (e.g., water, sediment, tissue).

Matrix Spike—A QC sample that is created by adding known amounts of analytes of interest to an actual sample, usually prior to extraction or digestion. The matrix spike is analyzed using the normal analytical procedures. The result is then corrected for the analyte concentration determined in the unspiked sample, and expressed as a percent recovery. This provides an indication of the sample matrix effect on the recovery of target analytes.

Method—A body of procedures and techniques for performing an activity that is systematically presented in the order in which they are to be executed.

Method Blank—A QC sample intended to determine the response at zero concentration of analyte and assess the positive contribution from sample analysis procedures to the final result; a clean matrix (generally water) known to be free of target analytes that is processed through the analytical procedure in the same manner as associated samples.

Method Detection Limit (MDL)—The minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero; determined from analysis of a sample in a given matrix containing the element.

Normalize—Perform a data calculation in order to express results in terms of a reference parameter or characteristic.

Percent RSD—Calculated by dividing the standard deviation by the mean and multiplying by 100.

Polymer—A chemical compound or mixture of compounds formed by polymerization and consisting essentially of repeating structural units.

Precision—The statistical agreement among independent measurements determined from repeated applications of a method under specified conditions. Usually expressed as relative percent difference, relative standard deviation, or coefficient of variation.

Qualified Data—Data to which data qualifiers have been assigned. Data qualifiers provide an indication that a performance specification in the qualified sample or an associated QC sample was not met, or that a special condition existed during the analysis of the sample.

Quality Assurance (QA)—An integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the customer.

Quality Assurance Project Plan (QAPP)—A formal planning document describing the necessary QA, QC, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria.

Quality Control (QC)—The routine application of procedures for obtaining prescribed standards of performance in the monitoring and measurement process. QC is an element of QA. QC sampling and auditing/assessment are common QC activities.

Quantification—The process of calculating the value of an analyte in a particular sample.

Quantification Limit Check Sample—A check sample containing target analytes at concentrations at or near the quantification limit; used to verify routing method performance at the quantification limit.

Receptor—An organism or medium that receives exposure to a toxic or harmful substance.

Recovery—The percentage difference between two measurements, before and after spiking, relative to the concentration spiked, or the percentage difference between a measured value and a true value, as in the case of a reference material or check standard.

Reference Material—A material of known analyte composition that can be used for comparison of analytical results.

Relative Percent Difference—Difference of two measurements x_1 and x_2 divided by the mean of the measurements, multiplied by 100.

Remedial Investigation (RI)—Any action that provides information on the extent and magnitude of contamination at a site. The purpose of the remedial investigation/feasibility study is to collect and develop sufficient site information enabling the selection of a cleanup action. This includes characterization of the former Rayonier Mill Site, risk assessment, and feasibility study.

Representativeness—A measure of the degree to which data accurately and precisely represent an environmental characteristic or condition.

Reproducibility—The ability to produce the same results for a measurement. Often measured by determining the RPD, RSD, or coefficient of variation for an analysis.

Risk—The probability of harm, including short-term and long-term effects, to human health, the ecology, or the quality of human life.

Risk Assessment (RA)—The process by which the form, nature, extent, and characteristics of a risk are estimated. Types include human health risk assessments (impact to people) and ecological risk assessments (impact to plants and animals).

Sampling and Analysis Plan (SAP)—A plan that includes information on sampling frequency, sampling locations, sampling procedures, chain of custody, acceptance criteria, analytical methods, and data quality management.

Semivolatile organic compounds (SVOCs)—Organic compounds with moderate or low vapor pressures that can be extracted from samples using organic solvents.

Spike—The addition of a known amount of a substance to a sample or a blank.

Spiked Method Blank—See "check standard".

Standard—A substance or material, the properties of which are believed to be known with sufficient accuracy to permit its use to evaluate the same property of a sample. In chemical measurements, standard often describes a solution of analytes used to calibrate an instrument.

Standard Reference Material—A material with known properties produced and distributed by the U.S. National Institute of Standards and Technology (NIST) or another recognized standards organization.

Surrogate Spike Compound—A compound that has characteristics similar to that of a compound of interest is not expected to be found in environmental samples, and is added to a sample prior to extraction. The surrogate compound can be used to estimate the recovery of chemicals in the sample.

Target Analytes—(or **Target Compounds**)—One or more elements or compounds that are intended to be determined by an analytical procedure (often in contrast to tentatively identified compounds).

Tentatively Identified Compounds—Compounds not considered to be primarily target analytes, but which are tentatively determined during analysis. Typically associated

control limits or QCs are not available for these compounds, hence the tentative identification.

Toxic Equivalent Concentration (TEQ)—A calculated concentration used to represent the toxicity of a dioxin sample so that it may be easily compared with another dioxin sample containing a different combination of some of the 210 compounds in the dioxin family. The process is to assign each member of the dioxin family a value weighted to the toxicity of the most toxic member of the group, 2,3,7,8-TCDD. This compound has a value of 1, while all others are some fraction of 1.

Validation—Confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled. It can refer to a process whereby environmental data are determined by an independent entity to be complete and final (i.e., subject to no further change), and to have their value for the intended use described by both qualitative and quantitative statements.

Volatile Organic Compounds (VOCs)—Organic compounds with high vapor pressures that tend to evaporate readily from a sample.

Volatilization—The process of vaporizing at a relatively low temperature.

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